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ECE 637
Exam #2

4 S, 2015

4.1) The columns of A are samples that could either be image data or some other data. The matrix $\hat{R}$ is an estimate of the covariance of the columns of A, averaged with $1/n$ because A has n columns. The columns of A may be obtained from some sampling or imaging process

4.2) $A = U\Sigma V^+$

$$\hat{R} = \frac{1}{n} AA^+ = \frac{1}{n}(U\Sigma V^+)(U\Sigma V^+)^+ = E\Lambda E^+$$

$$= \frac{1}{n} U\Sigma V^+ V\Sigma U^+ \quad ; \ \Sigma^+ = \Sigma$$

$$= \frac{1}{n} U\Sigma^2 U^+$$

$$\boxed{E = U \qquad \Lambda = \frac{1}{n}\Sigma^2}$$

4.3) $A = U\Sigma V^+$

$$B = \frac{1}{n} A^+A = \frac{1}{n}(U\Sigma V^+)^+(U\Sigma V^+) = TDT^+$$

$$= \frac{1}{n} V\Sigma U^+ U\Sigma V^+ \quad ; \ \Sigma^+ = \Sigma$$

$$= \frac{1}{n} V\Sigma^2 V^+$$

$$\boxed{T = V \qquad D = \frac{1}{n}\Sigma^2}$$